42. (New Claim) The embedded electroconductive layer according to claim 3, wherein said first material is amorphous TiSiN.

43. (New Claim) The embedded electroconductive layer according to claim 3, wherein said first material is Al_2O_3.

44. (New Claim) The embedded electroconductive layer according to claim 3, wherein said embedded electroconductive layer is a Cu layer, an Al layer, or an Al alloy layer having Al as a main component thereof.

REMARKS

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached Appendix is captioned "**Version with markings to show changes made.**"

As a preliminary matter, Applicant notes that an acknowledgment of the receipt and consideration of the Information Disclosure Statement (IDS) filed on July 9, 2001 has not been received. As an indication of the consideration of the references cited in the IDS, Applicant respectfully requests that an initialed copy of the Form PTO-1449 that accompanied the IDS be forwarded to Applicant's representative at the address of record.

For the Examiner's convenience, an additional copy of the Form PTO-1449 that accompanied the July 9, 2001 IDS is enclosed.

Applicant appreciates the Examiner's indication that Claims 5-7 have been allowed.

Applicant also appreciates the Examiner's indication that dependent Claim 3 contains allowable subject matter, and would be allowed if amended into independent form. In response, Applicant has amended Claim 3 into independent form by including therein the subject matter of base Claim 1. Accordingly, Applicant respectfully requests an indication of the allowance of Claim 3.

Claims 1 and 4 stand rejected under 35 U.S.C. § 102 (b) as being anticipated by United States Patent No. 4,990,997 to Nishida. Applicant respectfully traverses this rejection.

Applicant respectfully submits that the Nishida reference fails to disclose all of the features of the present invention. Specifically, Nishida fails to disclose an embedded electroconductive layer that includes, *inter alia*, the following *three*-layer structure: (1) a barrier layer made of a first material; (2) a metal growth promoting layer made of a second material that is different from the first material; and (3) a conductive layer, where all three of these layers are stacked, in order, on an insulating film on a substrate, as defined in independent Claim 1.

In contrast, Nishida discloses a *four*-layer structure comprised of: (1) a barrier layer; (2) an interface layer 16'; (3) another barrier layer 17; and (4) a conductive layer, all four of which are stacked, in order, on a substrate. Thus, between the substrate (or insulating film) and the conductive layer, the Nishida reference includes a three-layer structure (barrier layer/interface layer/barrier layer), while the present invention (as defined in Claim 1) only includes a two-layer structure (barrier layer/metal growth promoting layer), with each layer being of a different material. Thus, the present invention, as defined in Claim 1, is very different from Nishida.

Further, in the present invention of Claim 1, the barrier layer is made of a single material, and it independently serves as a barrier against the particles that compose the conductive layer. The metal growth promoting layer is provided for enhancing the deposition of the conductive layer (as opposed to simply depositing the conductive layer on the barrier layer, which takes longer without the metal growth promoting layer). In other words, each layer of the present invention of Claim 1 is made of a single material, and has a distinct function.

On the other hand, in Nishida, all three layers of the three-layer structure perform the same function – serving as a barrier to the particles of the conductive layer. More specifically, in Nishida, the barrier property is improved by disrupting the continuity of the grain boundaries between the lower barrier layer 15 and the upper barrier layer 17 with the interface layer 16'. *See* col. 2, line 61 through col. 3, line 27 of Nishida. Thus, interface

layer 16' is disclosed as being used to increase the barrier function. Moreover, there is no disclosure in Nishida of the recognition of the need for a metal growth promoting layer. Accordingly, all of the features of the present invention of Claim 1 are not disclosed in Nishida.

Furthermore, Applicant respectfully submits that first barrier metal layer 15 and second barrier metal layer 17 of Nishida cannot be considered as the claimed barrier layer and the claimed metal growth promoting layer, respectively. This is the case because both layers 15 and 17 of Nishida are disclosed as being of the same material. Accordingly, layers 15 and 17 are not made of a first material and a second material, respectively, that are different from each other, as defined in independent Claim 1.

Finally, Applicant also respectfully submits that the Examiner's characterization of the claimed barrier layer reading upon the combination of layers 15 and 16' of Nishida and the claimed metal growth promoting layer as reading upon layer 17 of Nishida does not satisfy Claim 1 either. The claimed barrier layer is defined in Claim 1 as being made of a first material. However, assuming *arguendo* that the Examiner can interpret TiN and oxidized TiN as two <u>different materials</u> (to arrive at the conclusion that layer 15/16' is a different material than layer 17), TiN and oxidized TiN cannot also be considered as being the <u>same material</u> when the barrier layer is defined as being of a "first material," as recited in Claim 1. In other words, it is improper for the Examiner to consider TiN and oxidized TiN as both a single "first material" when interpreting one portion of Claim 1, and

to also consider TiN and oxidized TiN as two different materials when interpreting a different part of Claim 1.

Thus, for at least the reasons discussed above, Applicant respectfully submits that Nishida does not disclose all of the features defined in Claim 1. Accordingly, since all of the claimed features are not disclosed in Nishida, Applicant respectfully requests the withdrawal of this § 102(b) rejection of independent Claim 1 and associated dependent Claim 4.

Applicant has also added new dependent Claims 37-43. New Claims 37-39 depend, either directly or indirectly, from independent Claim 1, and Applicant respectfully submits that these new claims are allowable for at least the reasons advanced above with regard to Claim 1. New Claims 40-43 depend from allowable independent Claim 3, and should be allowable for at least the same reasons that rendered Claim 3 allowable.

Additionally, with regard to new dependent Claim 37, Applicant also separately traverses this claim. Applicant respectfully submits that Nishida fails to disclose all of the features of the present invention of Claim 37. Specifically, Nishida fails to disclose an embedded electroconductive layer that includes, *inter alia*, a metal growth promoting layer situated on top of a barrier layer, with the metal growth promoting layer "having a thickness of at least approximately 10nm and being made of a second material that is different from said first material of said barrier layer," as defined in dependent Claim 37. One example of an embodiment of the present invention defined in Claim 37 is shown in Figures 7A-7E,

which includes, *inter alia*, a TiSnN barrier layer 14 and a TiN metal growth promoting layer 15. As disclosed on page 14, lines 1-4, the metal growth promoting layer 15 has a thickness of at least approximately 10nm.

In contrast, Nishida discloses a first barrier metal layer 15 and a second barrier metal layer 17, with an interface layer 16' on surface 16, which is the surface of the first barrier metal layer 15 between it and the second barrier metal layer 17. The first and second barrier metal layers 15 and 17 are disclosed as being of the same material (either TiN or $TiWS_2$), and the interface layer 16' is disclosed as being of the same material as the barrier metal layer 15, either with or without being oxidized.

Applicant respectfully submits that barrier metal layer 15 and interface layer 16' of Nishida cannot be considered as, respectively, the claimed barrier layer and the metal growth promoting layer of Claim 37 because the interface layer 16' of Nishida does not have a thickness "of at least approximately 10nm," as defined in dependent Claim 37. Although the exact thickness of interface layer 16' is not disclosed, it is disclosed that this layer does not necessarily have a substantial thickness that covers the entire surface of layer 15 uniformly, but may be a mere surface that is so thin that surface 16 and interface layer 16' are represented as the same part in the drawings. See Column 5, lines 53-61. Thus, interface layer 16' is clearly much thinner than the barrier metal layer 15 of Nishida, which is disclosed as being 50nm (500Å). Accordingly, in light of these disclosures in Nishida, Applicant respectfully submits that the interface layer 16' of Nishida does not have a

thickness of at least approximately 10nm, and therefore this layer cannot be considered as the claimed metal growth promoting layer defined in dependent Claim 37.

Claim 2 stands rejected under 35 U.S.C. § 103 as being unpatentable over Nishida in view of United States Patent No. 5,739,579 to Chiang et al. Applicant respectfully traverses this rejection.

Claim 2 depends from independent Claim 1, and therefore includes all of the features of Claim 1, plus additional features. Accordingly, Applicant respectfully request that the § 103 rejection of dependent Claim 2 under Nishida and Chiang et al. be withdrawn considering the above remarks directed to independent Claim 1.

For all of the above reasons, Applicant request reconsideration and allowance of the claimed invention. Should the Examiner be of the opinion that a telephone conference would aid in the prosecution of the application, or that outstanding issues exist, the Examiner is invited to contact the undersigned.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Claims 1 and 3 have been amended; new Claims 37-44 have been added as follows:

1. (Amended Three Times) An embedded electroconductive layer comprising:

any one of an opening part or a depressed part formed in an insulating film on a substrate;

a barrier layer covering said opening part or said depressed part, said barrier layer being made of a first material;

a metal growth promoting layer on said barrier layer, said metal growth promoting layer being made of a second material that is different from [that] said first material of said barrier layer; and

an electroconductive layer embedded in said opening part or said depressed part via said barrier layer and said metal growth promoting layer.

3. (Amended Three Times) [The] An embedded [electrconductive] electroconductive layer [according to claim 1] comprising:

any one of an opening part or a depressed part formed in an insulating film on a substrate;

a barrier layer covering said opening part or said depressed part;

a metal growth promoting layer on said barrier layer, said metal growth promoting layer being made of a material different from that of said barrier layer; and

an electroconductive layer embedded in said opening part or said depressed part via said barrier layer and said metal growth promoting layer;

wherein said metal growth promoting layer is a TiN layer containing oxygen at a lower concentration than said barrier layer.

37. (New Claim) The embedded electroconductive layer according to claim 1, wherein said metal growth promoting layer has a thickness of at least approximately 10nm.

38. (New Claim) The embedded electroconductive layer according to claim 1, wherein said metal growth promoting layer has a thickness of approximately 20nm.

39. (New Claim) The embedded electroconductive layer according to claim 1, wherein said barrier layer has a thickness of at least approximately 10nm.

40. (New Claim) The embedded electroconductive layer according to claim 3, wherein said first material is WN_x, where x is a variable such that $0 \leq x \leq 1$.

41. (New Claim) The embedded electroconductive layer according to claim 3, wherein said first material is TaN_x, where x is a variable such that $0 \leq x \leq 1$.

42. (New Claim) The embedded electroconductive layer according to claim 3, wherein said first material is amorphous TiSiN.

43. (New Claim) The embedded electroconductive layer according to claim 3, wherein said first material is Al_2O_3.

44. (New Claim) The embedded electroconductive layer according to claim 3, wherein said embedded electroconductive layer is a Cu layer, an Al layer, or an Al alloy layer having Al as a main component thereof.